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Mental disorders in early adulthood and later psychiatric hospital admissions in relation to mortality in a cohort study of a million men

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Abstract

Context: Mental disorders have been associated with increased mortality, but the evidence is primarily based on hospital admissions for psychoses. The underlying mechanisms are unclear.

Objective: To investigate whether the risks of death associated with mental disorders diagnosed in young men are similar to those associated with admission for these disorders, and to examine the role of confounding or mediating factors.

Design: Prospective cohort study in which mental disorders were assessed by psychiatric interview during a medical examination on conscription for military service at a mean age of 18.3 years and data on psychiatric hospital admissions and mortality during a mean 22.6 years of follow-up were obtained from national registers.

Setting: Sweden.

Participants: 1,095,338 men conscripted between 1969 and 1994.

Main outcome measure: All-cause mortality according to diagnoses of schizophrenia, other non-affective psychoses, bipolar or depressive disorders, neurotic/adjustment disorders, personality disorders, alcohol-related or other substance use disorders at conscription and on hospital admission.

Results: Diagnosis of mental disorder at conscription or on hospital admission was associated with increased mortality. Age-adjusted hazard ratios (95% confidence intervals) according to diagnoses at

conscription ranged from 1.81 (1.54, 2.10) (depressive disorders) to 5.55 (1.79, 17.2) (bipolar disorders). The equivalent figures according to hospital diagnoses ranged from 5.46 (5.06, 5.89) (neurotic/adjustment disorders) to 11.2 (10.4, 12.0) (other substance use disorders) in men born 1951-8 and increased in men born later. Adjustment for early-life socioeconomic status, body mass index and blood pressure had little effect on these associations, but they were partially attenuated by adjustment for smoking, alcohol intake, intelligence, education and late-life socioeconomic position. These associations were not primarily due to deaths from suicide.

Conclusions: The increased risk of premature death associated with mental disorder is not confined to those whose illness is severe enough for hospitalisation or to those with psychotic or substance-use disorders.

Unstructured abstract

Mental disorders are linked with increased mortality, but most evidence comes from hospital admissions and underlying mechanisms are unclear. In a cohort study of 1,095,338 male conscripts, we investigated whether the risks of death associated with mental disorders diagnosed at conscription were similar to those associated with admission for these disorders, and examined the role of confounding or mediating factors. Diagnosis of mental disorder at conscription or hospital admission was associated with increased mortality. Age-adjusted hazard ratios (95% confidence intervals) according to diagnoses at conscription ranged from 1.81 (1.54, 2.10) (depressive disorders) to 5.55 (1.79, 17.2) (bipolar disorders). The equivalent figures according to hospital diagnoses ranged from 5.46 (5.06, 5.89) (neurotic/adjustment disorders) to 11.2 (10.4, 12.0) (other substance use disorders) in men born in 1951-8 and increased in men born later. Adjustment for early-life socioeconomic status, BMI and blood pressure had little effect on these associations, but they were partially attenuated by adjustment for smoking, alcohol intake, intelligence, education and later-life socioeconomic position. These associations were not primarily due to deaths from suicide. The increased risk of death associated with mental disorder is not confined to those whose illness requires hospitalisation or to those with psychotic or substance-use disorders.

Introduction

People with severe mental illness, such as schizophrenia and other psychoses, and those with substance use disorders tend to have increased mortality.¹⁻⁵ These premature deaths are not primarily due to suicide or accidents – though risk of both is increased⁴ – but to a range of natural causes, particularly cardiovascular disease.^{2,3,6}

Most evidence on this association is based on individuals whose disorder was severe enough to require hospital admission.^{3,7,8} A few studies in community-based samples have shown that diagnosed depression is linked with increased mortality,⁹ but less is known about the effects on mortality of clinically-diagnosed neurotic or adjustment disorders, most cases of which do not need inpatient care. One such disorder – generalized anxiety disorder - may be an important cause of premature death.¹⁰

The reasons why mental disorder is associated with increased mortality from natural causes is uncertain. In some forms of mental illness, such as alcohol- or other substance use disorders, the disease itself contributes directly to mortality risk. Psychosocial factors such as lack of social support or socioeconomic disadvantage may partially mediate the association.⁸ However, the high prevalence of modifiable risk factors in people with severe mental illness may also play a part. Smoking, diabetes and obesity all occur more frequently in these individuals than in the general population,^{11,12} and hypertension too may be more common in this group, though a recent meta-analysis suggests that this difference in prevalence is slight.¹¹ In the few studies that have examined whether smoking mediates or confounds the association between mental illness and mortality, the extent to which it explained the association varied greatly.^{6,8} Little is known about the part that obesity or hypertension might contribute to the mental illness-mortality association.

In this study we used data on over a million Swedish men who underwent psychiatric and medical assessment as part of military conscription examinations in early adulthood and were followed up for psychiatric hospital admission and mortality for around 22.6 years. Our first objective was to investigate whether the risks of death associated with the range of disorders diagnosed in young men are similar to those associated with hospital admission for these disorders. For this, we separately determined all-cause mortality according to a diagnosis of schizophrenia, other non-affective psychotic disorders, bipolar disorders, depressive disorders, neurotic and adjustment disorders, personality disorders, alcohol-related disorders, or other substance use disorders in two groups of men, those diagnosed during the conscription examination and those diagnosed on hospital admission in the years following conscription. Our second objective was to examine the extent to which risk factors measured at conscription - blood pressure, body mass index, smoking, alcohol intake and intelligence, together with socioeconomic circumstances in childhood or later adult life - explained associations between diagnoses of mental disorder, either at conscription or on later hospital admission, and mortality.

Methods

Study participants and record-linkage of registers

The record linkage methods used to generate this cohort study have been reported previously.^{13,14}

The cohort comprised all non-adopted men born in Sweden from 1950 to 1976 for whom both biological parents could be identified in the Multi-Generation Register. Using unique personal identification numbers we linked the Multi-Generation Register with the Military Service Conscription Register, Population and Housing Censuses records (1960 and 1970), the Cause of

Death Register, and the National Hospital Discharge Register. This resulted in 1,346,545 successful matches. Study approval was obtained from the Regional Ethics Committee, Stockholm.

Conscription examination

The military service conscription examination involves a structured, standard medical assessment of physical and mental health, and intelligence. During the years covered by this study, the law required this examination; only men of foreign citizenship or those with severe disability (including that caused by mental illness) were excused. This dataset covers examinations from 15 September 1969 to 31 December 1994, after which testing procedures used to assess intelligence changed. Average age at examination was 18.3 years (range: 16 to 25).

Men underwent a medical examination during which blood pressure, height and weight were measured using standard protocols. Body mass index (BMI, kg/m^2) was calculated. The examination included a structured interview by a psychologist. Men who reported or presented any psychiatric symptoms were assessed by a psychiatrist. Diagnoses were made according to the Nordic version of the *International Classification of Disease* (ICD) versions 8 or 9.

Socioeconomic status in early life was based on the highest occupation of either parent from the 1960/1970 Population and Housing Censuses. The 1990 Census records were used to ascertain later life socioeconomic status. Socioeconomic status was classified in 5 categories: nonmanual (high/intermediate), nonmanual (low), skilled, unskilled, and other. Highest educational level was based on 4 categories (<9 years of primary school, 9–10 years of primary school, full secondary school, and higher education).

Intelligence was measured by four subtests representing verbal, logical, spatial, and technical abilities.¹⁵ All test scores – including a total score (IQ) – were standardized at source to give a Gaussian-distributed score between 1 and 9. Higher values indicate greater intellectual capacity.

For a subgroup of participants conscripted 1969-1970 only (n=34,561), information was collected on smoking (>20, 11–20, 6–10, 1–5 cigarettes/day; nonsmoker) and alcohol consumption. Alcohol consumption was assessed using responses to questions regarding frequency and average consumption of alcohol measured in grams per week. Risky use of alcohol was defined as the presence of at least one of the following: (1) consumption of 250+ g 100% alcohol per week, (2) ever consumed alcohol during a hangover, (3) ever been apprehended for drunkenness and (4) often been drunk (response options in the questionnaire were ‘often’, ‘rather often’, ‘sometimes’, and ‘never’).¹⁶

Hospital admissions

The Swedish National Hospital Discharge Register covers virtually all in-patient care for psychiatric disorders (including admissions to forensic psychiatric clinics) since 1973, with the exception of admissions in a few counties during some of the early years of data collection.¹⁷ Admissions were coded according to the Nordic version of the *International Classification of Disease* versions 8, 9 or 10. We extracted data on psychiatric admissions from 1968 to December 31st 2004.

We grouped diagnoses (primary and secondary) from the conscription examinations and hospital admissions into the following categories using the ICD codes shown in Table 1: schizophrenia, other non-affective psychotic disorders (excluding alcohol or drug psychoses), bipolar disorders,

depressive disorders, neurotic and adjustment disorders, personality disorders, alcohol-related disorders (including alcoholic psychoses), and other substance use disorders (including drug psychoses).

Analytical sample

Of 1,346,545 men whose records were matched, 1,095,338 had complete data on psychiatric diagnoses at the conscription examination and the covariates. We used these 1,095,338 men to examine the relation between mental disorders at conscription and mortality. We then excluded 8081 men who had been admitted to psychiatric hospital prior to conscription, and used the remaining 1,087,257 men to examine the relation between hospital admission for mental disorders after conscription and mortality.

Statistical methods

Having checked that the proportional hazards assumption was met, we used Cox proportional hazards models to examine all-cause mortality according to whether men had been diagnosed with a mental disorder at conscription. Survival time in days was calculated from date of conscription to date of death, date of emigration, or 31st December 2004 - whichever occurred first. In total, 90.1% of the participants were followed up to 31st December 2004. We adjusted for age at conscription, conscription testing centre, and year of testing, and then, in addition, for early-life socioeconomic status, BMI, diastolic blood pressure, IQ, education and later-life occupational social class. We adjusted for diastolic blood pressure because diastolic blood pressure predicts mortality more strongly than systolic blood pressure in this cohort.¹⁸ In the subset with data on smoking and alcohol intake, we examined the effect on the associations of adjustment for these factors.

To examine the risk of death according to diagnosis on hospital admission, we used Cox models in which diagnosis was treated as a time-varying covariate and adjusted for the covariates as above. As later born men had a shorter follow-up time than those born earlier and were conscripted when hospitalisation for mental disorders was less common,⁵ we investigated whether associations between diagnoses on hospital admission and mortality varied according year of birth. There was evidence that these associations were significantly stronger in men born later. We therefore conducted separate Cox models for hospital admissions and mortality according to whether men had been born in 1951-8, 1959-67 or 1968-76. These models met proportional hazards assumptions. Associations between diagnoses at conscription and mortality did not vary by year of birth.

We estimated the impact on the hazard ratio of adjusting for a particular covariate using the following formula¹⁹: $([\text{hazard ratio}_{\text{adjusted for age}} - 1] - [\text{hazard ratio}_{\text{adjusted for age and covariate}} - 1]) / [\text{hazard ratio}_{\text{adjusted for age}} - 1] \times 100$.

Results

Diagnoses of mental disorders during the conscription examination

In total, 61,677 (5.6%) of our sample of 1,095,338 men were diagnosed with schizophrenia, other non-affective psychotic disorders, bipolar disorders, depressive disorders, neurotic and adjustment disorders, personality disorders, alcohol-related disorders, or other substance use disorders during the conscription examination. During the follow-up period, 15,110 men died. Table 2 shows hazard ratios (95% confidence intervals) for all-cause mortality according to whether men had received one of these diagnoses at conscription. (The proportion of men with severe mental disorder was small because individuals with very disabling illness before age 18 years were excused from conscription.) In analyses adjusting for age at conscription, conscription testing centre and

year of testing, men who had received a diagnosis of any of these disorders had a significantly higher risk of death than those who had not been so diagnosed. Men diagnosed with bipolar disorders, schizophrenia or substance use disorders had the highest increase in risk (between 3.5 and 5.5 times those without these disorders), but risk was also nearly doubled in men with neurotic/adjustment disorders. Further separate adjustment for early-life SES, BMI or diastolic blood pressure at conscription had little attenuating effect on these associations. In general, adjustment for intelligence had the strongest attenuating effect but the percentage reduction in the estimates was small, between 17% and 30%. Adjustment for education and later-life SES had a small attenuating effect on most of the estimates, but slightly strengthened that between other non-affective psychoses and mortality. Even after adjusting for all covariates simultaneously, although some attenuation was seen, men diagnosed with a mental disorder had a risk of death that was between 1.5 and 5.2 times that of men without such a diagnosis. In total, 0.9% of deaths in men diagnosed with a mental disorder at conscription were due to suicide (definite or uncertain). Exclusion of these deaths markedly weakened the association between bipolar disorder and mortality, but other associations were little attenuated, or even slightly strengthened.

We checked whether results shown in Table 2 differed in men who were excluded from the sample due to incomplete data on the covariates; age-adjusted estimates differed little.

In the subset of this sample who were conscripted between 1969 and 1970 ($n=34,561$) we were able to examine the extent to which smoking and alcohol intake at conscription accounted for the link between mental disorder and mortality. During the follow-up period there were 1297 deaths in this subgroup. There were too few cases of schizophrenia or bipolar disorder to permit analysis of these diagnoses, but in general smoking and drinking appeared to provide only a partial explanation for

the links between other types of mental disorder and mortality (Table 3). Smoking habits accounted for between 15% and 36% of the associations between the various types of mental disorders at that age and mortality. Risky alcohol intake accounted for between 6.8% and 49% of these associations. Unsurprisingly, it was the associations between substance use disorders and mortality that were attenuated most strongly by adjustment for these factors. By contrast, neither of these behaviours appeared to account for more than a tiny proportion of the link between other non-affective psychoses and mortality.

In total, 28% of men with a diagnosis of mental disorder at the conscription examination ($n=17,224$) were diagnosed with more than one type of disorder at that time, and 18% ($n=11,310$) were admitted to psychiatric hospital during follow-up. To investigate whether the associations between each disorder at conscription and mortality were concentrated among those with comorbidity or with a subsequent history of hospitalisation, we repeated our analyses excluding these men in turn. Effect sizes changed little when men with comorbidity were excluded and were only slightly attenuated when men with a subsequent history of hospitalisation were excluded (data not shown).

In the sample as a whole, 8081 men (0.7%) had a history of inpatient psychiatric care prior to conscription. Only 19% of these men were given a diagnosis of mental disorder during the conscription examination, perhaps because they did not report or show the type of symptoms during the psychological assessment that led to referral for psychiatric examination. Under-diagnosis of mental disorder in these men at conscription might mean our results do not accurately reflect the effect of such diagnoses on mortality risk. We therefore repeated our analyses excluding all men who had been admitted to psychiatric hospital prior to conscription. In the remaining

sample of 1,087,257 men, effect sizes for the relation between diagnoses of mental disorder at conscription and mortality were virtually the same as those obtained in the full sample (data not shown), with the sole exception of diagnoses for schizophrenia where effect sizes increased (the age-adjusted HR (95% CI) was 5.02 (2.25, 11.2) compared to 3.78 (1.68, 8.31) in the full sample).

Diagnoses of mental disorders on hospital admission during follow up

Of the 1,087,257 men in our sample of 1,095,338 who had no history of hospital admission for mental disorder at conscription, 60,333 (5.5%) had at least one admission during the follow-up period. Of these 60,333 men, 1807 (3%) emigrated after admission so were lost to follow-up at that point and 4879 died (8.1%). Table 4 shows hazard ratios (95% confidence intervals) for all-cause mortality according to diagnoses during hospital admission and year of birth. The proportion of men admitted to hospital with any diagnosis fell in successive birth cohorts. In general, the risk of death associated with hospital admission was higher in later born cohorts: after adjustment for age, conscription testing centre and year of conscription, men born in 1951-8 had a risk of death that was between 5 and 11 times higher than their contemporaries who had not been admitted, while men born in 1968-76 had a risk of death that was between 7 and 29 times higher. Further separate adjustment for early-life SES, BMI or diastolic blood pressure at conscription had little attenuating effect on these associations; adjustment for BMI slightly strengthened some associations.

Adjustment for intelligence or for education and later-life SES tended to have a stronger attenuating effect, but after adjusting for all covariates simultaneously, hospital admission for mental disorder was associated with a markedly higher risk of death in all three birth cohort groups. The proportion of deaths by the end of follow-up in 2004 that was due to suicide (definite or uncertain) ranged from

20% in men born in 1951-8 to 32% in men born in 1968-76. Exclusion of these deaths attenuated most associations to some extent, particularly in the latter group, but risk of premature death remained high: men born in 1951-8 had a risk of death that was between 3 and 9 times higher than men who had not been admitted, while men born in 1968-76 had a risk of death that was between 4 and 17 times higher.

In the subset of this sample conscripted between 1969 and 1970, we examined the extent to which smoking or risky drinking at the time of conscription explained these associations (Table 5). The largest attenuating effect was seen in the case of admission for other substance use disorders where adjustment for smoking habits and risky drinking attenuated the associations with mortality by 18% and 21% respectively.

In total 38% of men who were admitted to hospital were diagnosed with more than one disorder, either concurrently or sequentially. To explore whether the increased mortality associated with hospital admission was concentrated among this group we repeated our analyses excluding men with comorbidity. Estimates were slightly lower after this exclusion (data not shown).

Among the 60,333 men admitted to psychiatric hospital following conscription, 10,665 had also been diagnosed with a mental disorder during the conscription examination. These men had higher mortality than those who were admitted to psychiatric hospital during the follow-up period but were free of mental disorder at the time of conscription: compared to men who were not diagnosed with mental disorder, either at conscription or on hospital admission, the odds ratio (95% CI) for dying prematurely (adjusted for age, year of conscription and conscription testing centre) was 8.45 (8.13,

8.79) in men admitted to hospital but with no prior diagnosis and 12.4 (11.7, 13.3) in men who had early onset mental disorder and required hospital admission subsequently. By contrast, compared to men who were not diagnosed with mental disorder, either at conscription or on hospital admission, the odds of premature death in men who were diagnosed with mental disorder at conscription but never subsequently required inpatient care was 1.93 (1.81, 2.07).

Discussion

In this cohort of over a million men, we examined the mortality risk of two groups with mental disorders, one comprising young adults diagnosed primarily with milder forms of illness during a psychiatric examination at conscription, and one made up of men whose illness was severe enough to require hospital admission during follow-up. Those who were diagnosed with a mental disorder at conscription had a risk of death that was around 2 to 5 times higher than those who were not so diagnosed. This increase in risk was not due primarily due to death from suicide and not confined to those with psychotic or substance-use disorders: men with a neurotic or adjustment disorder - the most common diagnosis in this group - were nearly twice as likely to die as those without these disorders. In the group of men who were diagnosed with a mental disorder on admission to hospital after conscription, risk of death was even higher, particularly in those born later. Suicide increased among Swedish male psychiatric patients during the latter part of our follow up period.⁵ Consistent with this, exclusion of suicide deaths had the strongest attenuating effect on our estimates for the relation between mental disorders on hospital admission and mortality among the latest born men, but risk of death remained high. In the sample as a whole, risk of death was highest in men who were diagnosed with a mental disorder in young adulthood and later admitted to psychiatric hospital. As regards explanatory factors, BMI or blood pressure measured at the time of

conscription or early-life SES played little or no part in these associations. Smoking habits and risky alcohol intake at conscription accounted for some of the increased risk of death associated with having a substance use disorder at this time, but in general these behaviours appeared to play only a minor part. Adjustment for intelligence at conscription, education and later-life SES tended to have the strongest attenuating effect on the mental disorders-mortality associations.

Most previous studies into the link between mental disorder and mortality have been based on individuals who required hospitalisation,^{3,7,8} or other specialist psychiatric care.²⁰ Consistent with these studies, we found that men admitted to hospital had a markedly higher likelihood of dying prematurely. Evidence on the relation between mental disorder diagnosed during surveys of non-psychiatric samples and mortality is still relatively sparse and largely confined to studies of depression.⁹ Our findings that a clinical diagnosis of a neurotic/adjustment disorder or a personality disorder during a screening examination in early adulthood was associated with an approximately 2-fold risk of death, even in those with no evidence of comorbid mental illness, suggests that the mortality risk associated with mental disorder is not limited to those whose disease is severe enough to require inpatient care.

The mechanisms underlying the link between mental disorders and all-cause mortality remain unclear. The fact that in the present study risk of death was markedly higher in the hospitalised group – especially in those who were diagnosed with mental disorder at conscription and subsequently hospitalised - suggests that severity of illness, and perhaps length of exposure to severe illness, play some part in the association. Consistent with this, educational attainment and later-life SES appeared to have a stronger mediating role in the association between mental disorder and mortality among men who were diagnosed on hospital admission than among those who were

diagnosed during the conscription examination. Deprivation and poor living conditions are risk factors for physical illness and tend to occur more commonly in people with severe mental disorder. The presence of severe mental illness may affect educational attainment and achieved SES, but there is also evidence that lower SES directly, and indirectly through adverse economic circumstances, increases risk of mental disorder.²¹

Lower intelligence in early life has been linked with an increased risk of developing mental disorders²²⁻²⁴ and of premature death.^{19,25} Here, IQ accounted for between 17% and 30% of the associations between mental disorders at conscription and mortality. IQ explained rather less of the associations between later hospital admissions and mortality, where education and later-life SES tended to play a much larger role, but it may have an indirect part in the associations via its influence on educational attainment and achieved SES.^{26,27}

Other possible explanations for the associations between mental disorder and all-cause mortality are lifestyle factors and other risk factors, such as obesity and hypertension.^{8,28} Risky alcohol intake at conscription accounted for nearly 50% of the association between alcohol-related or other substance use disorders at this age and mortality, but it seemed to play little part in associations between other types of disorder and mortality. It also explained very little of the link between hospital admission for substance use disorders and mortality. Smoking habits appeared to explain between 15% and 36% of the associations between mental disorders diagnosed at conscription and mortality, consistent with earlier observations,⁸ but very little of the associations between hospital admission for mental disorders and mortality. It is possible that for many men self-reports of smoking and drinking behaviour at conscription provided only a partial reflection of how much they smoked or drank at the time of hospital admission, or indeed at conscription. There is evidence that low

levels of physical activity and poorer dietary quality may be more common in people with severer forms of mental illness,^{8,28-30} but we were unable to examine the role of these lifestyle factors. Little is known about the possible role that BMI and blood pressure may play in the associations between mental disorder and mortality, and evidence that these factors are linked with mental disorder is inconsistent.^{8,11,12,28} Here, we found very little indication that either factor played a part in the links between mental disorders and all-cause mortality.

Other potentially important explanations for the associations that we were unable to examine in the present study are chronic physical illness, access to physical health care and psychotropic medication. The prevalence of a range of physical illnesses tends to be higher in people with mental disorder;³¹ much of this may go undetected, particularly in those with more severe illness, due to poorer assessment and care of physical illness.³¹⁻³⁴ Antipsychotic medications may contribute to mortality risk through their influence on cardiometabolic risk factors.^{31,35}

The strengths of this study are its size and the availability of data on diagnoses made during the conscription examination which enabled us to examine the effect of a clinical diagnosis of different types of mental disorder on mortality in a non-psychiatric sample. A further strength is the availability of information on BMI, blood pressure, smoking habits and alcohol intake at conscription which allowed us to explore the extent to which these explained associations between mental disorder and mortality. Our study also has some weaknesses. The first limitation is that our study is based on men only. The extent to which these findings can be extrapolated to women is uncertain. Several studies have shown that psychiatric patients of both sexes have higher mortality than the general population,^{2,3,5-7} though these risks are usually, but not always,⁶ greater in men than in women. Whether this apparent sex difference reflects differential use of medical care or variations

in health behaviours is unclear. Secondly, although we had data on some behavioural and physiological risk factors at conscription, we had no information on other potentially important mediating factors such as physical activity or diet.³⁶ Thirdly, we had no data on risk factors measured at the time of first hospital admission for psychiatric care, other than clinical diagnosis. As some men were first admitted up to 22 years after conscription, the measurements made at conscription may not always be an accurate reflection of these characteristics at the time of hospital admission. Fourthly, it is possible that the extent of mental disorder at the time of conscription was underestimated because referral for psychiatric assessment depended on whether men showed signs or reported symptoms suggestive of mental health problems during the psychological examination; furthermore, men with severely disabling illness were excused from conscription and our sample excluded men who were adopted or whose records could not be linked to both biological parents. Our findings may therefore underestimate the true strength of the association between mental disorders in the general population of young men and mortality risk. On the other hand, malingering may have led some men to report symptoms falsely in the hope of being excused army service. Fifthly, inpatient psychiatric care in Sweden, as elsewhere, has become increasingly less common.⁵ The men in our study who were identified as having mental disorders on the basis of hospital admission, particularly in later birth cohorts, are therefore likely to be those with more severe illness. Finally, it is worth noting that while the earliest born men in our sample were 55 years old by the end of follow-up, the latest born were at most 36 years old so their follow-up was shorter and main causes of death may differ. This, coupled with possible differences between birth cohorts in severity of illness in hospitalised cases, may help explain why mortality associated with hospital admission was greater in later born men.

Our findings demonstrate that the increased risk of premature death associated with mental disorder is not confined to those with psychotic or substance-use disorders, or to those whose illness is severe enough to need inpatient care. Neurotic/adjustment disorders, personality disorders, depressive or bipolar disorders, substance use disorders, schizophrenia and other non-affective psychotic disorders were each associated with an increased risk of dying prematurely, even in men who received such a diagnosis during screening for conscription. Smoking, alcohol intake, intelligence and indicators of socioeconomic position in later life may partially mediate the associations between some mental disorders and mortality, though BMI and blood pressure appeared to play little part. If this huge burden of premature mortality is to be reduced, the physical health care of people with mental illness needs to be a greater priority for medical care providers.

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Table 1: Diagnostic categories and codes according to the 8th, 9th & 10th revision of the ICD

Diagnostic category	ICD-8	ICD-9	ICD-10
Schizophrenia	295	295	F20-21, F25
Other non-affective psychoses	297.0-9, 298.2-3, 298.9	297, 298.2-4, 298.8-9	F22-24, F28-29
Bipolar disorders	296.1, 296.3, 298.1	296.0, 296.2-5, 298.1	F30-31
Depressive disorders	296.0, 296.2, 298.0, 300.4	296.1, 298.0, 300.4, 311	F32-34, F38-39
Neurotic/ adjustment disorders	300.0-3, 300.5-9, 305, 307	300.0-3, 300.5-9, 306, 308-9	F40-48
Personality disorders	301	301	F60-69
Alcohol-related disorders	291, 303	291, 303, 305.0	F10
Other substance use disorders	294.3, 304	292, 304, 305.1-8;	F11-F19

Abbreviations: ICD, International Classification of Diseases

Table 2: Hazard ratios¹ (95% confidence intervals) for all cause mortality according to diagnosis of mental disorders at conscription (n=1,095,338)

Diagnostic category	No (%) diagnosed	Adjustments, HR (95% CI)							
		Age	Age & early-life SES	Age & BMI	Age & diastolic blood	Age & IQ	Age, education & later-life SES	All covariates	All covariates & excluding deaths from suicide
Schizophrenia	73 (<0.001)	3.78 (1.68, 8.31)	3.73 (1.68, 8.32)	3.75 (1.68, 8.24)	3.70 (1.66, 8.24)	2.99 (1.34, 6.66)	2.71 (1.22, 6.03)	2.52 (1.13, 5.72)	2.69 (1.12, 6.47)
Other non-affective psychoses	12,366 (1.1)	1.98 (1.77, 2.21)	1.98 (1.77, 2.21)	1.83 (1.64, 2.04)	1.95 (1.76, 2.17)	1.81 (1.62, 2.02)	1.75 (1.56, 1.95)	1.62 (1.45, 1.81)	1.69 (1.49, 1.91)
Bipolar disorders	31 (<0.001)	5.55 (1.79, 17.2)	5.78 (1.86, 17.9)	5.52 (1.78, 17.1)	5.55 (1.79, 17.2)	4.88 (1.57, 15.1)	5.55 (1.79, 17.2)	5.19 (1.67, 16.1)	2.29 (0.32, 16.3)
Depressive disorders	9,237 (0.9)	1.81 (1.54, 2.10)	1.78 (1.53, 2.08)	1.76 (1.51, 2.06)	1.77 (1.52, 2.07)	1.66 (1.42, 1.95)	1.59 (1.36, 1.86)	1.53 (1.31, 1.79)	1.51 (1.26, 1.81)
Neurotic/adjustment disorders	47,296 (4.3)	1.83 (1.73, 1.93)	1.81 (1.71, 1.91)	1.80 (1.71, 1.91)	1.81 (1.71, 1.91)	1.61 (1.52, 1.71)	1.54 (1.45, 1.62)	1.48 (1.40, 1.57)	1.39 (1.49, 1.59)
Personality disorders	8,940 (0.8)	2.53 (2.31, 2.78)	2.47 (2.25, 2.70)	2.55 (2.33, 2.80)	2.52 (2.30, 2.76)	2.12 (1.93, 2.32)	1.93 (1.76, 2.12)	1.88 (1.72, 2.06)	1.93 (1.74, 2.14)
Alcohol-related disorders	2,606 (0.2)	3.69 (3.21, 4.24)	3.54 (3.08, 4.07)	3.64 (3.16, 4.18)	3.65 (3.17, 4.20)	2.89 (2.51, 3.32)	2.50 (2.17, 2.87)	2.38 (2.07, 2.74)	2.48 (2.13, 2.90)
Other substance use disorders	9,372 (0.9)	3.53 (3.23, 3.86)	3.56 (3.22, 3.95)	3.52 (3.17, 3.90)	3.53 (3.19, 3.91)	3.12 (2.82, 3.46)	2.74 (2.47, 3.04)	2.68 (2.41, 2.97)	2.80 (2.49, 3.15)

Abbreviations: HR, hazard ratio; CI, confidence interval; BMI, body mass index; SES, socioeconomic status; IQ, intelligence quotient. ¹All adjustments include conscription testing centre and year of examination. BMI, diastolic blood pressure, and IQ were all measured at conscription. The reference group in each case consists of men who were not diagnosed with the disorder in question.

Table 3: Hazard ratios¹ (95% confidence intervals) for all cause mortality according to diagnosis of mental disorders at conscription: men conscripted in 1969-70 only (n=34,561)

Diagnostic category	No (%) diagnosed	Adjustments, HR (95% CI)		
		Age	Age & smoking habits	Age & risky alcohol intake
Other non-affective psychoses	500 (1.5)	1.59 (1.11, 2.29)	1.50 (1.08, 2.15)	1.55 (1.08, 2.24)
Depressive disorders	381 (1.1)	1.46 (0.95, 2.43)	1.31 (0.85, 2.03)	1.35 (0.88, 2.09)
Neurotic/adjustment disorders	2073 (6.0)	1.39 (1.14, 1.70)	1.28 (1.05, 1.56)	1.30 (1.06, 1.58)
Personality disorders	934 (2.7)	2.35 (1.87, 2.95)	2.04 (1.62, 2.57)	1.97 (1.56, 2.48)
Alcohol-related disorders	154 (0.5)	4.75 (3.22, 7.01)	3.55 (2.44, 5.28)	2.91 (1.95, 4.34)
Other substance use disorders	207 (0.6)	3.04 (1.99, 4.63)	2.30 (1.50, 3.51)	2.17 (1.42, 3.33)

Abbreviations: HR, hazard ratio; CI, confidence interval. ¹All adjustments include conscription testing centre and year of examination. Smoking and risky alcohol intake were measured at conscription. The reference group in each case consists of men who were not diagnosed with the disorder in question. ²There were too few cases of schizophrenia (n=10) or bipolar disorder (n=1) for separate analysis.

Table 4: Hazard ratios¹ (95% confidence intervals) for all cause mortality according to diagnosis of mental disorders on hospital admission after conscription and year of birth (n=1,087,257)

Diagnostic category and year of birth ²	No (%) diagnosed ³	Age	Age & early-life SES	Age & BMI	Adjustments				
					Age & diastolic blood pressure	Age & IQ	Age, education & later-life SES	All covariates	All covariates, & excluding deaths from suicide
Schizophrenia									
1951-58	2,745 (0.75)	5.84 (5.21, 6.55)	5.85 (5.22, 6.56)	5.97 (5.32, 6.69)	5.78 (5.16, 6.48)	5.03 (4.48, 5.64)	4.09 (3.64, 4.59)	4.00 (3.55, 4.49)	2.98 (2.56, 3.45)
1959-67	2,006 (0.59)	10.4 (8.91, 12.0)	10.4 (8.93, 12.1)	10.6 (9.10, 12.4)	10.2 (8.83, 12.0)	8.85 (7.59, 10.3)	7.69 (6.58, 8.98)	7.51 (6.43, 8.78)	4.17 (3.25, 5.25)
1968-76	1,024 (0.27)	20.7 (16.3, 26.3)	20.6 (16.2, 26.1)	21.0 (16.5, 26.6)	20.8 (16.3, 26.3)	17.9 (14.1, 22.8)	14.5 (11.4, 18.4)	14.8 (11.6, 18.8)	5.05 (3.08, 8.28)
Other non-affective psychoses									
1951-58	2,627 (0.71)	7.67 (6.86, 8.56)	7.65 (6.85, 8.55)	7.75 (6.93, 8.65)	7.62 (6.82, 8.51)	6.75 (6.04, 7.54)	6.00 (5.36, 6.69)	5.83 (5.22, 6.52)	4.30 (3.73, 4.97)
1959-67	2,276 (0.67)	11.7 (10.1, 13.5)	11.8 (10.2, 13.6)	11.8 (10.2, 13.7)	11.6 (10.0, 13.4)	10.2 (8.82, 11.8)	9.40 (8.13, 10.9)	9.14 (7.89, 10.6)	5.25 (4.18, 6.60)
1968-76	1,423 (0.37)	17.4 (13.9, 21.9)	17.3 (13.8, 21.8)	17.6 (14.0, 22.1)	17.4 (13.9, 21.9)	15.2 (12.1, 19.1)	13.3 (10.6, 16.7)	13.6 (10.8, 17.1)	6.07 (4.01, 9.18)
Bipolar disorders									
1951-58	1,229 (0.33)	6.14 (5.08, 7.41)	6.18 (5.11, 7.46)	6.14 (5.09, 7.42)	6.13 (5.07, 7.40)	5.73 (4.74, 6.93)	5.54 (4.86, 6.69)	5.41 (4.48, 6.54)	3.41 (2.62, 4.45)
1959-67	854 (0.25)	10.5 (8.03, 13.6)	10.5 (8.06, 13.7)	10.5 (8.08, 13.7)	10.4 (7.98, 13.5)	10.1 (7.74, 13.1)	9.47 (7.27, 12.3)	9.34 (7.17, 12.2)	4.21 (2.61, 6.79)
1968-76	444 (0.12)	8.77 (4.85, 15.9)	8.80 (4.86, 15.9)	8.76 (4.84, 15.8)	8.77 (4.85, 15.9)	8.38 (4.63, 15.2)	8.18 (4.52, 14.8)	8.23 (4.55, 14.9)	4.44 (1.66, 11.9)

Table 4 cont.

Depressive disorders									
1951-58	7,336 (1.99)	6.55 (6.05, 7.09)	6.46 (5.97, 6.99)	6.61 (6.11, 7.16)	6.54 (6.04, 7.08)	5.92 (5.47, 6.41)	5.45 (5.03, 5.90)	5.37 (4.96, 5.82)	3.56 (3.20, 3.95)
1959-67	4,325 (1.28)	10.7 (9.36, 12.1)	10.5 (9.24, 12.0)	10.8 (9.48, 12.3)	10.6 (9.34, 12.1)	9.48 (8.32, 10.8)	8.84 (7.76, 10.1)	8.72 (6, 9.95)	3.83 (3.05, 4.81)
1968-76	2,620 (0.69)	17.4 (14.2, 21.3)	17.3 (14.2, 21.9)	17.5 (14.3, 21.5)	17.4 (14.2, 21.3)	15.7 (12.9, 19.3)	13.4 (11.0, 16.4)	13.6 (11.1, 16.6)	5.75 (4.00, 8.33)
Neurotic/ adjustment disorders									
1951-58	8,697 (2.36)	5.46 (5.06, 5.89)	5.36 (4.96, 5.78)	5.51 (5.11, 5.95)	5.44 (5.04, 5.87)	4.85 (4.50, 5.24)	4.41 (4.09, 4.76)	4.35 (4.03, 4.70)	3.28 (2.98, 3.62)
1959-67	5,945 (1.76)	8.31 (7.39, 9.34)	8.19 (7.29, 9.20)	8.39 (7.46, 9.43)	8.27 (7.36, 9.29)	7.23 (6.43, 8.13)	6.70 (5.95, 7.53)	6.58 (5.85, 7.40)	4.24 (3.57, 5.04)
1968-76	3,448 (0.91)	6.58 (6.21, 6.96)	10.6 (8.73, 13.0)	10.8 (8.83, 13.1)	10.7 (8.82, 13.1)	9.26 (7.59, 11.3)	7.59 (6.22, 9.25)	7.74 (6.34, 9.44)	4.81 (3.56, 6.50)
Personality disorders									
1951-8	3,312 (0.90)	6.89 (6.25, 7.60)	6.75 (6.11, 7.44)	7.01 (6.36, 7.74)	6.87 (6.22, 7.58)	5.87 (5.31, 6.48)	5.00 (4.53, 5.53)	4.91 (4.44, 5.42)	3.90 (3.44, 4.41)
1959-67	2,259 (0.67)	12.2 (10.7, 14.0)	12.1 (10.5, 13.8)	12.5 (10.8, 14.3)	12.1 (10.6, 13.9)	10.1 (8.80, 11.6)	8.77 (7.63, 10.1)	8.58 (7.46, 9.88)	5.10 (4.11, 6.33)
1968-76	1,194 (0.37)	12.7 (9.63, 16.6)	12.5 (9.49, 16.4)	12.7 (9.70, 16.8)	12.7 (9.63, 16.6)	10.8 (8.20, 14.2)	7.91 (6.01, 10.4)	8.00 (6.08, 10.5)	4.79 (3.10, 7.38)
Alcohol-related disorders									
1951-8	15,478 (4.20)	11.7 (11.1, 12.3)	11.5 (10.9, 12.1)	11.8 (11.2, 12.4)	11.7 (11.1, 12.2)	10.6 (10.1, 11.2)	9.23 (8.82, 9.79)	9.32 (8.84, 9.82)	9.01 (8.55, 9.61)
1959-67	7,901 (2.34)	13.7 (12.6, 15.0)	13.5 (12.4, 14.7)	13.9 (12.7, 15.1)	13.7 (12.5, 14.9)	11.8 (10.7, 12.9)	10.4 (9.46, 11.4)	10.3 (9.36, 11.3)	9.51 (8.49, 10.7)
1968-76	4,515 (1.19)	10.9 (9.21, 12.8)	10.7 (9.07, 12.6)	10.9 (9.22, 12.8)	10.9 (9.21, 12.8)	9.28 (7.86, 11.0)	7.52 (6.36, 8.89)	7.71 (6.52, 9.10)	6.48 (5.20, 8.08)

Table 4 cont.Other substance
use disorders

1951-8	5,740 (1.56)	11.2 (10.4, 12.0)	11.0 (10.3, 11.8)	11.4 (10.6, 12.2)	11.2 (10.4, 12.0)	9.88 (9.21, 10.6)	8.13 (7.57, 8.74)	8.12 (7.56, 8.73)	7.66 (7.05, 8.33)
1959-67	4,386 (1.30)	19.0 (17.3, 20.9)	18.7 (17.0, 20.6)	19.2 (17.5, 21.2)	18.9 (17.2, 20.8)	16.1 (14.6, 17.7)	13.6 (12.3, 15.1)	13.5 (12.2, 14.9)	13.1 (11.5, 14.8)
1968-76	2,774 (0.73)	29.0 (25.0, 33.6)	28.5 (24.6, 33.0)	29.0 (25.1, 33.7)	29.0 (25.0, 33.6)	23.7 (20.4, 27.6)	16.3 (14.0, 18.9)	16.8 (14.4, 19.5)	17.2 (14.3, 20.7)

Abbreviations: HR, hazard ratio; CI, confidence interval; BMI, body mass index; SES, socioeconomic status; IQ, intelligence quotient. ¹All adjustments include conscription testing centre and year of examination. BMI, diastolic blood pressure, and IQ were all measured at conscription. The reference group in each case consists of men who were not diagnosed with the disorder in question. ²The number of deaths and number of men in each birth cohort group is as follows: 1951-8: 8,420 deaths in 368,334 men; 1959-67: 3,824 deaths in 338,317 men; 1968-76: 2,587 deaths in 380,606 men. ³Percentages of men diagnosed on admittance in individual birth cohorts

Table 5: Hazard ratios¹ (95% confidence intervals) for all cause mortality according to diagnosis of mental disorders on hospital admission after conscription: men conscripted in 1969-70 only (n=33,677)

Diagnostic category	No (%) diagnosed	Adjustments, HR (95% CI)		
		Age	Age & smoking habits	Age & risky alcohol intake
Schizophrenia	272 (0.01)	5.56 (4.09, 7.56)	5.57 (4.09, 7.58)	5.28 (3.88, 7.18)
Other non-affective psychoses	239 (0.01)	7.86 (5.77, 10.7)	7.54 (5.54, 10.3)	7.39 (5.43, 10.1)
Depressive disorders	798 (2.4)	5.10 (4.10, 6.35)	4.64 (3.73, 5.79)	4.66 (3.73, 5.78)
Bipolar disorders	129 (0.004)	4.26 (2.41, 7.53)	4.37 (2.48, 7.74)	3.98 (2.25, 7.04)
Neurotic/adjustment disorders	858 (2.5)	4.39 (3.53, 5.45)	4.07 (3.27, 5.05)	4.02 (3.23, 5.00)
Personality disorders	357 (1.1)	5.36 (4.08, 7.04)	4.74 (3.60, 6.23)	4.49 (3.40, 5.92)
Alcohol-related disorders	1776 (5.3)	10.1 (8.90, 11.5)	9.04 (7.91, 10.3)	9.30 (8.11, 10.7)
Other substance use disorders	505 (1.5)	10.1 (8.22, 12.4)	8.47 (6.87, 10.4)	8.22 (6.65, 10.2)

Abbreviations: HR, hazard ratio; CI, confidence interval. ¹All adjustments include conscription testing centre and year of examination. Smoking and risky alcohol intake were measured at conscription. The reference group in each case consists of men who were not diagnosed with the disorder in question.